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**USE OF THE TRAY PACK RATION DURING
EXTENDED FIELD OPERATIONS: A SUMMARY**

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The effectiveness of the T Ration system was evaluated to see if it could adequately sustain Marines without causing excessive weight loss and/or GI symptoms during a 60-day Marine construction mission. The findings regarding the effectiveness of the T Ration reflect how it was actually used, not as theoretically planned. Therefore, this study was a valid and representative measure of the T Ration system as it often functions and the problems that may affect consumption and nutrient intakes. These problems include: lack of vegetable and fruit enhancements at most meals, unavailability of some menu items, hot storage conditions, poor food presentation, and an overworked mess staff. Volunteers (n=85) were randomly assigned to either 2 T Rations and 1 MRE or 2 B Rations and 1 MRE per day. In the T group 19 volunteers all with the rank of E-4 or below dropped from the study for food-related reasons, while there were no B group drops. A total of 17 in the T group and 34 in the B group completed the study. Neither group reported GI symptoms. The type of ration did not affect sleep, mood or physical performance. Weight loss, which did not differ between groups exceeded the 3 % criterion by Day 56. Mean energy expenditure was 3328 kcal/d. Both groups were in negative energy balance. However, in comparison to administrative personnel and construction engineers in the B group, construction engineers in the T group experienced the greatest energy deficit (-950 kcal/d). Total energy intakes were lower in the T group than in the B group and decline over time; 2702 to 2580 to 2423 kcal /d for the T group over the 3 test periods and from 3094 to 2822 to 2687 kcal/d in the B group. Mean nutrient intakes of the T group did not meet the MRDAs for energy, folate, magnesium, and zinc, and also did not reach dietary recommendations for carbohydrate and fiber. T Rations were initially acceptable, but ratings declined to dislike after repeated exposure. When volunteers were asked what they would recommend to the Commandant of the Marine Corps about feeding policy, 31 % stated morale would suffer with T Rations. Modification of the T Ration menu and enforcement of enrichment policies are necessary if the T Ration is to be considered during extended deployments.

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INTRODUCTION

There is currently no policy on the use of Tray Pack Rations (T Rations) for extended durations. The T Ration is a heat and serve ration that feeds 12-18 people per tray. The United States Marine Corps (USMC) requested (1) that information be obtained to allow the Office of the Army Surgeon General to establish a T Ration feeding policy for extended durations. Specifically, the information requested would address the nutritional adequacy and impact on associated health and performance indices of T Ration consumption for extended periods of time while Marines performed their assigned mission (e.g., we examined a 60-day construction mission completed by combat engineers). Currently, the USMC uses B Rations (cook-prepared) as the standard field ration. While the T Ration provides most nutrients at levels of the Nutritional Standards for Operational Rations (2), it was necessary to determine if Marines (or soldiers) would consume sufficient amounts of the rations to meet their nutritional needs. Details of our research are reported separately (3). This document summarizes the conclusions and recommendations regarding extended feeding of T Rations based on the findings of that study.

SUMMARY OF FINDINGS

RATION/NUTRITION ISSUES

1. Overall, energy intake in Marines consuming T Rations was lower than those given B Rations.
 - T Ration Group: 2572 kcal/day (49% CHO, 15% PRO, 36% Fat, <1% ALC)¹.
 - B Ration Group: 2886 kcal/day (50% CHO, 14% PRO, 35% FAT, 1% ALC).
2. T Rations were not well accepted by the Marines when fed continuously for 60 days.

¹CHO = carbohydrate, PRO = protein, FAT = fat, ALC = alcohol

- 44% of volunteers in the T Ration group, all with ranks of E-4 and below, discontinued eating T-Rations prior to the end of the 60-day study.
 - No volunteer from the B Ration control group withdrew from the study because of the food.
3. The relatively consistent quality of the T Ration could be an advantage during prolonged field feeding.
- The subjective quality of T Ration foods was lower than that of B Ration foods, but the subjective quality of T Ration foods remained constant over time.
 - The subjective quality of B Ration foods decreased over time as ingredients ran out and the cooks became fatigued.
 - Energy intakes from galley food mirrored the perceived changes in quality with intakes remaining relatively stable throughout the 60-day deployment for the T Ration group but declining over time in the B Ration group.
 - Despite equal access, the T Ration group tended to consume lesser quantities of Meals, Ready-to-Eat and non-ration foods than the B Ration group.
 - When it was expected the food would be disliked (e.g., the T Ration), there was less inclination to utilize other available foods.
 - When the expectation of liking was not met over time (e.g., the B Ration), alternate foods were consumed to maintain the expected level of meal satisfaction.
4. Both diets failed to achieve certain Military Recommended Dietary Allowances (MRDAs).
- The T Ration group failed to consume sufficient energy, folate, magnesium, and zinc as compared to MRDAs and did not meet dietary recommendations for carbohydrate and fiber.
 - The B Ration group failed to consume zinc at MRDA levels and did not meet dietary recommendations for carbohydrate and fiber.
5. Ration enhancements and supplements were not effectively utilized nor as recommended (4).

- Some enhancement items (e.g., cold cereals and salad dressing) were not procured prior to the deployment or from a local source after deploying because of perceived high cost.
 - Some supplemental items (e.g., salads, fresh fruits and vegetables) were procured initially, but ran out and were not replaced because procurement from local sources was perceived to be too costly and time-consuming.
 - The shelf-stable bread was more than one year out-of-date, resulting in degraded taste and texture.
6. Energy densities (kcal/g of food and beverage consumed) were lower than optimal and decreased over time.
- Intake of artificially sweetened beverages (little or no calories) increased as environmental temperatures increased.
 - No energy compensation occurred, and energy intakes declined in parallel with energy density.
7. Differences in acceptability ratings of like/dislike of foods existed between ration groups.
- All T Ration breakfast entrees were disliked, but no B Ration breakfast entrees were disliked.
 - T Ration dinner items were initially liked by a majority of Marines, but after 30 days a majority of the items served were disliked.
 - No B Ration dinner items were rated as disliked.
8. There was a lack of choice in T Ration breakfasts with some form of eggs and/or hash served every day, leading to menu monotony.
9. Over the deployment, the kitchen staff became fatigued and dispirited, which could negatively affect the cooks' ability to provide consistent, high quality meals throughout a long deployment.
- Kitchen staff had extended work days and did not have an entire day off (unlike most members of the unit).
 - Cooks seemed to receive little appreciation for their efforts.

10. When volunteers were asked what feeding policy the Commandant of the Marines should adopt for B and T Rations, 31% mentioned that B Rations should be maintained and that a switch to T Rations would hurt troop morale.

HEALTH AND PERFORMANCE ISSUES

1. The construction mission was completed on time and without incident.
2. There were no differences in physical symptoms reported in the two feeding groups.
3. In both groups, energy expenditure exceeded energy intake, leading to weight loss.
 - Energy requirements were between 3000-4000 kcal/day for this mission.
 - Weight loss exceeded 3% in both feeding groups by Day 56 of the study.
 - Weight loss, while not overly excessive, began to accelerate in the second month for both ration groups.
 - Some individuals began to rely increasingly on outside food sources as time proceeded.
 - Mean total daily energy expenditure (TDEE) was higher for the construction engineers (3460 kcal/day) than administrative and support personnel (3109 kcal/day).
 - Negative energy balances (i.e., consuming fewer calories than expended) were greater for construction engineers than administrative and support personnel eating T Rations, and these differences became greater over time.
 - During the last week of the construction mission, construction engineers consuming the T Ration exhibited an energy balance of -1650 kcal/day vs. a -500 kcal/day energy balance for those consuming the B Ration.
4. Muscle strength (as indicated by repeated bench press lifting, arm curl lifting, and vertical jump performances) was not affected by consumption of T or B Rations.

5. Volunteers slept an average of 6.5 hrs per night, with no differences between ration groups.
6. Hydration status was not affected by the type of ration consumed. During particularly hot days and/or hard physical work, fluid intake was less than optimal, as assessed by urine specific gravities.
7. Measured mood status was not significantly different between ration groups.

RECOMMENDATIONS

- Incorporate or change to A Rations (fresh and perishable foods) as soon as logistically possible during a long deployment to meet energy needs, prevent weight loss, and improve the acceptability of meals.
- Consider the likelihood of the unavailability of fruit and vegetable supplements, the unavailability of some menus or menu items, and less than optimal storage conditions at the deployment site when recommending the length of time for continuous T Ration feeding.
- Rotate T Ration menus to minimize ration monotony.
- Provide alternatives to T Ration eggs and hash in the morning such as waffles, biscuits, pancakes (e.g., from the Unitized Group Heat & Serve Ration or developmental items), and additional instant oatmeal in the breakfast menus to improve energy intake and acceptability of breakfasts in general.
- Provide individual boxes of cold cereal to enhance the breakfast menu.
- Present and serve foods in appealing and familiar ways to increase the overall acceptability of the T Ration.
- Provide condiments such as ketchup, mustard, soy sauce, etc.

- Provide sugar-sweetened beverages to increase energy intake.
- Provide ration supplements (e.g., salads, fresh fruits and vegetables) when possible.

SUMMARY AND CONCLUSIONS

Our research showed that serving T Rations for 60 days did not negatively impact the health or performance of Marines deployed on a construction mission in a tropical environment. However, acceptability of the T Ration was an issue. T Rations were rated lower and ratings decreased over time. Breakfasts in particular were rated as unacceptable by the majority of Marines. It should be noted that the evaluation of the T Ration reflected how the ration was actually used and not as theoretically planned. Consideration needs to be given on ways to improve the T Ration system to minimize the problem of poor acceptability which can lead to insufficient consumption, low nutrient intakes, and may negatively impact troop morale and mission readiness. Ration developers may want certain low-rated items to be improved or replaced by more desirable items. However, the primary emphasis on improvements may be on ensuring that the T Ration system operates as envisioned. Provision of vegetable and fruit supplements, enforcement of enhancement policies, shipment of a balanced set of all breakfast and dinner menus, proper rotation of menus, elimination of forced issue of out-of-date items, and a qualified mess staff that is sufficiently staffed to ensure proper storage, preparation and service of rations are all factors which need consideration if the T Ration is to be used on extended deployments.

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